

The sea-level temperature maps show strikingly the gradients in temperature along the coasts, which in winter are particularly steep along the Murman coast and the northeastern shore of the Black Sea. In spring the contrasts in the south are much diminished, but in the northeast they are very great indeed, amounting in April to 12° C. in $7\frac{1}{2}^{\circ}$ of latitude, or 1.6° C. (2.9° F.) per latitude degree. The summer months show striking contrast (about 6° C. difference in July) between the chilly Arctic coast and the northern tundra. The larger lakes show a 2° or 3° C. excess of temperature relative to land in autumn and an equal deficiency in early summer. The annual range is under 20° on the western Arctic coasts, but 27° to 30° only 50 miles from the northern shore. In eastern and southeastern Russia the range is 34° to 39° C.

The advance of spring and fall as shown by the five isothermal maps for different temperatures indicate strikingly how spring bursts upon the plains of central Russia and how suddenly winter sets in. In central Russia the -5° , 0° , 5° , and 10° isotherms advance 400 to 700 miles in 10 days in spring, but not quite so fast in fall. In the north, however, the advance is slowed to 100 miles in 10 days. Correspondingly, the changes in temperature from month to month reach large values in spring and fall, mostly 7° to 11° for April to May and 6° to 9° for September to October.

The maps of frequencies of days above certain temperatures indicate great differences, especially in the number of days over 15° C., which might be called mild days. These range from 150 in the Crimea to 100 about latitude 52° , 50 at latitude 61° , and 0 at latitude 65° .

The maps are clearly presented, being black lines on a light brown hachured base, with blue for water (two shades, for shallow and deep). The scale is ample and the isothermal interval, 1° C., small enough for all required detail.

THE DRY SEASON OF THE PANAMA CANAL

By R. Z. KIRKPATRICK, *Chief of Surveys*

[Balboa Heights, C. Z., May 25, 1931]

1. The drawing on the opposite page is historical of the beginning and ending of the Canal Zone's dry seasons since American occupation.

2. It will be noted that there are considerable variations; but an approximate average is: Beginning January 1, ending May 5; length, 4 months 5 days.

3. The inset curve indicates the number of lockages Gatun Lake's available storage would have provided, after allotting 1,700 c. f. s. for making hydroelectric power, during each year since the canal began operation in 1914. It is evident that the Madden Dam and Reservoir (happily under construction) will be needed to tide over very dry seasons, and that the contemplated new locks and storage reservoir will take care of traffic needs until many decades from now.

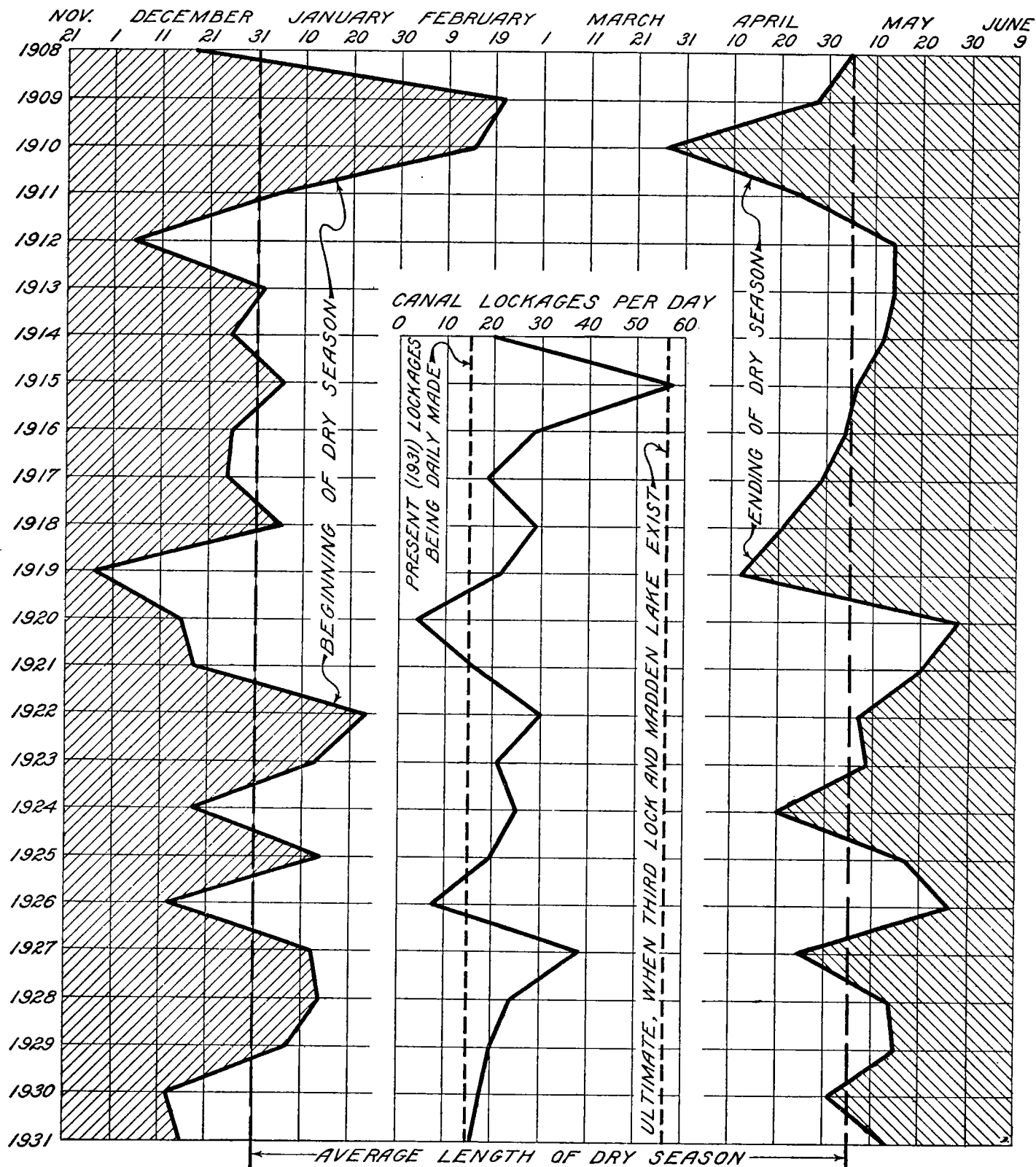
THE CLEVELAND, OHIO, STORM, JUNE 26, 1931

By G. HAROLD NOTES

A violent storm, with resulting heavy damage, occurred during midday in Cleveland on June 26, 1931.

Distant mutterings of thunder had been heard during the preceding night beyond the Lake Erie horizon, with lightning showing behind the peaks of distant cumuli. The 8 a. m. observation of the 26th did not show any notably unusual conditions, other than its being oppressively warm, with temperature of 80° and relative humidity of 74 per cent. With the rising of the sun, tem-

peratures moved upward to correspond, and the wind shifted from west to southward at 7:55 a. m. Later developments, however, led to the conclusion that even before 8 o'clock a great convectional disturbance was accumulating over Lake Erie to the west-northwestward of Cleveland. Cloud cover increased very rapidly, commencing at 8 o'clock; the sun was obscured at 8:04 a. m., and a gentle shower began at 8:29 a. m., the wind at that time shifting from southwest through west for 3 minutes, into northwest for 12 minutes, thence into north for 20 minutes, northeast for 30 minutes, then east for 22 minutes, then back to north for 6 minutes; the winds were a little gusty, but not rising above 18 miles per hour. Meantime the gentle shower continued, and temperature dropped from 80° to 71° . The barogram showed a slight notch, down and up, immediately after 8 o'clock. Distant thunder was heard at intervals from 7 a. m. on. Between 9 and 10 a. m. the activity of the lower clouds was confused, but highly significant of later developments. Detailed movements in four levels were observed, reading down: From west-northwest and west, north, and at lowest level varying rapidly from northeast, east, and east-southeast. At 10:36 a. m. gentle rain suddenly became excessive, amounting to 0.28 inch in about $5\frac{1}{2}$ minutes, with wind remaining under 12 miles per hour. This rainfall catch was excellent. At 11 a. m. rain again reached a rapid but not excessive rate, with wind not rising above 15 miles per hour, mostly from the southeast. From 10 a. m. to 1 p. m. the barometer showed marked activity; from 10:10 to 10:20 there was a quick fall and rise; from 11 to 11:30 it fell 0.06 inch, then commenced rising, and rose about 0.15 inch by 1 o'clock. During this period the brunt of the storm swept over the city from the lake. At 11:49 a. m. the storm broke, the wind rose from 8 to 12 miles per hour in less than a minute to 56, with an extreme of 64 at 11:52, and rain commencing at excessive rate and continuing to 12:10 p. m., and the wind continuing above 45 to 12:15, the rain catch, therefore, at this period was considerably deficient, but was recorded as 0.41 in 15 minutes. The wind, rain, and lightning during this period, immediately before and after noon, did severe damage. Lightning struck in many places; two men were killed outright and buildings damaged, and several electric circuits were burned out. The wind blasted shrubbery and foliage, uprooted trees, and broke off limbs, so that damage of this sort was widespread throughout the city, and thence to the eastward into the next county. The rainfall was at such rate that watercourses, both natural and those recently constructed, were inadequate to carry the runoff. In nearly all down-town localities there was little or no flooding, but in eastern parts of the city and suburbs underpasses were flooded, stopping traffic, cellars filled, culverts were washed out, and road surfaces and curbs undermined. Some insecure buildings were razed by the wind, and many plate-glass windows on the south side of Public Square were blown in. Windows in many scattered sections were broken, and this was followed by rain damage. Hail fell from 10:36 to 10:39 a. m., the pellets being up to three-eighths inch in diameter; the hail was unimportant and any damage therefrom was obliterated by the more serious damage a short time later. The pellets were flattened, showing concentric layers, finely traced. Precipitation from hail was probably not over a trace. The margins of the storm reached into central portions of the State, with greatly weakened energy, and as its maximum focus advanced eastward, or east-southeastward, into Pennsylvania it rapidly diminished in force. It was felt only slightly at Erie, Pa., and



Graphical presentation of beginning and ending of dry season at Panama Canal, 1908-1931, and other data. The extent of dryness is expressed in canal lockages per day, 1914-1931, inclusive. Note: It is assumed that one lockage per day requires 70 c. f. s., that Gatun hydroelectric leakage and municipal water requires 1,700 c. f. s., and that Gatun Lake's storage between elevations 87 and 81 feet is used.

little, if any, at Buffalo, N. Y. The western margins of the storm were near Sandusky, without damage.

Storm-sewer construction and catch basins in the areas immediately near Public Square appeared to be adequate for the run-off of this storm, but in the highlands and eastern suburbs, either the recent construction of water-courses and their resultant constriction is woefully undersized, or else the rain in that region was much greater than down town.

The loss, according to newspaper headlines, was in the millions.

A TORNADO IN NEW MEXICO¹

By C. E. LINNEY

[Weather Bureau Office, Santa Fe, N. Mex.]

Just about a year after a destructive tornado struck Wagon Mound, Mora County, N. Mex., a second tornadic

storm was observed to form on June 5, 1931, near the small village of French, Colfax County, about 35 miles northeast of Wagon Mound. This second tornado moved slowly east-southeast through a thinly settled country, doing but relatively little damage by reason of the sparsely settled country. It passed into and across Union County, doing quite a bit of damage to buildings and causing the death of a 3-year-old girl by an out-building crashing upon her. The property loss in the Gladstone district is estimated at about \$1,500 and in the Barney and Sedan districts about \$10,000 and \$20,000, respectively.

The tornado was under observation during its entire course of about 90 miles. It dissipated after crossing the Texas border.

¹ Condensed from the original.—Ed.

BIBLIOGRAPHY

C. FITZHUGH TALMAN, in charge of Library

RECENT ADDITIONS

The following have been selected from among the titles of books recently received as representing those most likely to be useful to Weather Bureau officials in their meteorological work and studies:

Bjerknes, V., & Solberg, H.

Zelluläre Trägheitswellen und Turbulenz. Oslo. 1929. 16 p. 24 cm. (Norske videnskaps-akad. i Oslo i matem.-natur. kl. 1929. no. 7.)

Bruzon, E., & Carton, P.

Le climat de l'Indochine et les typhons de la mer de Chine. Hanof. 1930. 310 p. figs. plates (part fold.). 27½ cm. (Num. spec. des Annales du serv. met.)

Franssila, M.

Die Häufigkeit der verschiedenen Windgeschwindigkeiten an aerologischen Observatorium Ilmala. Helsingfors. 1930. 15 p. figs. 24 cm. (Mitt. des Met. inst. der univ., Helsingfors. N:o 16.)

Gamba, Pericle.

Sulla temperatura del suolo a Pavia. (Risultati di un ventennio di osservazioni geotermiche nell' R. Osservatorio geofisico.) Roma. 1929. 50 p. plates (part fold.). 25 cm. (Parma. Uff. idrog. del Po. Pubbl. n. 11.)

Great Britain. Air ministry. Airship services division.

Conditions along airship routes. Preliminary report on routes between England (Cardington), Egypt (Ismailia), and India (Karachi). September. n. p. n. d. 24 p. charts (fold.). 33 cm. (Airship met'l rep. 80.)

International commission for the exploration of the upper air.

Ergebnisse der aerologischen Messungen. 24. I. 1925: 17.-22. VIII. 1925. Berlin. 1930. 23, 172 p. 30 cm. [Author, title and text in German, French, and English.]

Jenny, Hans.

Study on the influence of climate upon the nitrogen and organic matter content of the soil. Columbia. 1930. 66 p. figs. 23 cm. (Univ. Mo. Coll. agric. Agr. expr. sta. res. bull. 152.)

Johansson, Osc, V.

Der mittlere Verlauf der Lufttemperatur in der Winternacht. Helsingfors. 1931. 26 p. 24 cm. (Mitt. des met. Inst. der Univ., Helsingfors. N:o 17.)

Middleton, W. E. Knowles.

Measurement of visibility at night. p. 39-48. figs. 25 cm. (Trans. R. S. C. sec. III, 1931.)

Miller, A. Austin.

Climatology. London. [1931.] x, 304 p. figs. 23 cm.

Molchanov, P. A.

Investigation of upper layers of atmosphere by method of radio sounding in Arctic condition. Leningrad. 1931. 12 p. figs. 28 cm. (Repr.: Mag. sci. res. bur. 1st issue.) [Author, title and text in Russian. English translation typewritten.]

Nagler, Floyd A.

Drought of 1930 in Iowa. Iowa City. 1931. 16 p. figs. 23½ cm. (Univ. Iowa exten. bull. Bull. no. 266. Apr. 15, 1931.)

Petersen, Helge.

Theoretical determination of the heights of the stratosphere, the ozone layer and the height of maximum luminosity of the aurora. København. 1931. 19 p. figs. 25 cm. (Pub. Danske met. inst. Comm. mag. no. 13.)

Pettersson, O.

Flodkraften och vattenutbytet mellan de tropiska och de Polara haven. En studie i geofysik och kosmisk fysik. [Göteborg. 1930.] 18, 10 p. illus. 34 cm. (Svenska hydrog.-biol. komm. skrifter. Ny ser. Hydrografi VIII.)

Schultze, Herbert.

Die Schwankungen der barometrischen Hochlagen über Mitteleuropa und ihr Einfluss auf die Ernteerträge in Deutschland. Halle. 1928. 141 p. figs. 25 cm. (Inaug.-Dissert. Verein. Friedrichs-Univ. Halle-Wittenberg.)

Svensson, Aron.

Verdunstung und Abkühlung oder Erwärmung in einem laminaren Gasstrom von konstanter Geschwindigkeit. Anwendung auf Assmann's Aspirations-psychrometer. Stockholm. 1931. 28 p. figs. 22 cm. (Arkiv för mat., astron. och fysik utg. av K. Svenska vetenskapsakad. Bd. 22 A. N:o 23.)

Taylor, C. Fayette.

Suggested method for measuring turbulence. Washington. 1931. 7 p. plates. 26½ cm. (Tech. notes, Nat. adv. comm. for aeron. No. 380.) [Manifolded.]

Väisälä, Vilho.

Die Wolkenhöhen in Finnland. Helsingfors. 1930. 28 p. figs. 24½ cm. (Mitt. des met. Inst. der Univ., Helsingfors. N:o 15.)

Waring, F. H., & Stewart, F. D.

Effect of the 1930 drought upon Ohio public water supplies. p. 18-23. 23 cm. (Engin. exper. sta. news. Ohio state univ. Suppl. v. 3, no. 3. June, 1931.)

Welter, L.

La pluie à Dakar et l'activité solaire. p. 264-271. figs. 25½ cm. (Bull. du com. d'études hist. et sci. de l'Afrique occid. franç. T. 13, no. 2. Année 1930. Avr.-juin.)